GRASSLAND BYPASS PROJECT

11 Quality Control

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Data Quality Objectives

The Data Collection and Reporting Team (DCRT) uses the laboratory data from this project to support the determination of whether Selenium (Se) levels in the Grassland Bypass exceed regulatory compliance levels. Because individuals use the data generated by this program for regulatory compliance and baseline monitoring purposes, the data must be of the highest degree of reliability. Sample collection from different environmental media and analytical methods performed by the laboratories must adhere to the guidelines established in the quality assurance project plan (QAPP).

Quality Assurance Project Plan

The QAPP defines the data quality objectives (DQOs) for the Monitoring Program, and each agency has established DQOs for their environmental measurements. The QAPP addresses both quantitative goals, including precision, accuracy, and completeness, and qualitative goals, including representativeness and comparability.

The QAPP includes all the requirements identified in the August 1994 Draft Interim Final, "U.S. EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations", EPA QA/R-5. It describes quality assurance/quality control (QA/QC) protocol associated with each agency's sample collection and laboratory activities; provides acceptance criteria for data validation procedures; and describes corrective actions to be taken when data fail to meet such criteria. The DCRT tailored the QAPP specifically to provide the necessary protocol for the documentation of QA/QC activities.

Quality Assurance Oversight

QA/QC oversight for the Monitoring Program is the responsibility of the U.S. Bureau of Reclamation (USBR). A QA/QC oversight manager (QAQCOM) serving in a cooperative capacity ensures the implementation of commitments, guidelines, practices, and protocols outlined in the QAPP in compliance with the goals and objectives of the project. The QA staff of the USBR's Mid Pacific Region located in Sacramento, CA carries out this oversight role. They use guidelines, protocols, and criteria established in the QAPP to monitor and validate data collected by USBR personnel and to assess the data collection and validation processes used by the other participating agencies. When USBR identifies a noncompliance QA issue, they notify the appropriate QA Officer, and the agency implements corrective actions to resolve the problem. USBR brings any unresolved issues between the QAQCOM and a participating agency's QA Officer to the attention of the Data Collection and Reporting Team (DCRT) for resolution.

As part of the QA oversight responsibility, USBR conducts audits of all participating environmental laboratories and reviews the data collection activities of the participating agencies for adherence to protocol.

Sampling groups participating in the Monitoring Program conduct system audits of one another's protocols by reviewing the sampling method in the field. For example, CDFG conducted a system audit of USFWS's sampling group and vice versa.

Quality Assurance Accomplishments

Laboratory Performance and System Audits

USBR's QA staff conducted performance and system audits of the following laboratories:

Laboratory / Location	Date(s)	Analysis Type
Trace Substance Laboratory in Rolla, Missouri	April 30 & May 1, 1996	Tissue Analysis
Severn Trent Services Laboratory in West Sacramento, California	October 10, 1996; July 10 & 11, 2001	Water Analysis
U.S. Geological Survey' s Geological Division Laboratory in Denver, Colorado	December 2 & 3, 1998; July 17 & 18, 2001	Sediment Analysis
Twining Laboratory in Fresno, CA	June 22 & 23, 1999	Water Analysis
South Dakota State University Laboratory in Brookings, South Dakota	September 23, 1999	Water Analysis
Water Pollution Control Laboratory in Rancho Cordova, California	January 13 & 14, 2000	Tissue Analysis
Weck Laboratories in City of Industry, California	August 10 & 11, 2000	Water Analysis
BES Laboratory in Pleasant Hill, California	September 28, 2000	Toxicity Analysis

During 2001, the QA staff was able to audit the Severn Trent Services Laboratory and the U.S Geological Survey's Geological Division Laboratory. The audit process involves an initial demonstration of performance

using external quality assurance samples followed by a review of the latest version of the laboratory's QA Manual, the laboratory's performance study results for the past three years, and the laboratory's most recent internal or external audit report with corrective actions. Once the laboratory has demonstrated good performance and passed the initial document review process, the QA staff will conduct an on-site system audit. During the on-site system audit, the USBR QA staff reviews all of the detailed aspects of the quality system to ensure laboratory personnel understand and adhere to the protocols cited in the laboratory QA manual. The auditors then send an audit report which addresses all of the deficiencies identified during the system audit to the laboratory with a recommended time frame for the laboratory to respond, implement and document the corrective actions. The following tables are examples of how USBR summarized and documented performance sample results for the Severn Trent Services Laboratory and the U.S Geological Survey's Geological Division Laboratory (Table 1 and 2).

The two laboratories audited by the USBR QA staff in 2001 performed well on the system audit. Where USBR observed deficiencies during the on-site system audit, the laboratories have incorporated our recommendations or are in the process of implementing them.

Sample Collection System Audits

Participating agencies performed sample collection system audits on each other during 1997, and 1998. Since the methodology did not change, participating agencies did not conduct field audits on each other during 2001. During the annual sediment monitoring of the San Luis Drain for the Grassland Bypass Program on June 5th and 6th in 2001, USBR QA staff conducted a field audit of USBR's Mid Pacific Region Environmental Monitoring Team (EMT). The field audit focused on the quality of the environmental samples collected by the EMT and the ability of the EMT to adequately support and document the sample collection process. The purpose of the field audit was to identify and prevent problems in the field which could compromise sample integrity. Even though the field audit of the EMT found some deficiencies and deviations from stated protocols, overall the USBR QA staff found EMT members to be very knowledgeable and skilled in collecting environmental sediment samples for the Grassland Bypass Project. Since the field audit, the EMT has remedied all deficiencies and deviations from stated protocols.

Data Validation Activities

The following routine data validation activities were performed to ensure data reliability as stated in the QAPP:

Type of data & field logbooks	Validation Group
Sediment data from USBR	USBR QA staff
Water data from CVRWQCB	USBR QA staff
Biota data from USFWS	USBR QA staff
Toxicity data from BES	USBR QA staff
Field logbooks from USBR's sampling group	USBR QA staff

Table 1. Severn Trent Services Laboratory Performance Study
EPA Method 300.0A Sample ID QA463;
Date Completed: 06/25/00 Matrix = Water mg/L

Parameter	Result	True Value	% Recovery	Acceptance Limit
Sulfate	1200	1180	102	80 - 120

Table 2. U.S Geological Survey Laboratory Performance Study
Date completed: 8/20/01 Matrix = Soil mg/Kg

Sample ID	Parameter	Result	True Value	% recovery	Acceptance Limit
QA450	Selenium	79	79.6	99	80 - 120
QA451	Total Org. Carbon	8200	8500	96	80 - 120

Data Validation Methods

The QAQCOM is responsible for ensuring the participating agencies properly validate their analytical results, identify problems with their analytical data, and contact their respective laboratories to initiate corrective actions. To accomplish these tasks, USBR QA staff routinely reviews and validates the data produced by the participating agencies.

USBR QA staff assesses the validity of the analytical results by comparing QC results to acceptance criteria identified in Table 9 of the QAPP. The guidelines address both internal and external QC sample results. The QAPP defines internal QC samples as those check samples incorporated by the laboratories performing the work and defines external QC samples as those check samples submitted to the laboratories by the contracting agency. USBR QA staff ensures agencies are incorporating correct numbers and types of external QC samples into each batch of field samples during the data validation process and addresses any nonconformance issues with the agencies directly. Another assessment activity performed by the QA staff is to make sure participating agencies spike their external QC check samples at concentrations near historical levels as a means of ensuring better sample accuracy.

As part of this data validation process, USBR brings laboratory QC summary report problems to the attention of the each agency's QA officer. The QA Officers then address these problems with the laboratories. For example, QA Officers may request laboratories take proper corrective actions on internal QC check sample results outside of established control limits. USBR also checks data packages to ensure laboratories document details of their corrective actions in the case narrative section or as footnotes in the QC summary section.

Reviewing data packages to identify possible outliers is another part of the validation process. Once USBR QA staff identifies a data point as a possible outlier, they promptly request the laboratory re-analyze the sample. For example, USBR QA staff identified the sediment sample selenium result of 110 ug/g for monitoring Site B collected on March 7, 2001 as a potential outlier. Project field personnel sampled this site seventeen times from June 1996 through March 2001 with the following selenium results: 30, 20, 40, 42, 0.11, 48, 41, 45, 26, 17, 23, 31, 26, 39, 29, 19, and 110 ug/g respectively for the whole core sample as shown in Table 3. Upon re-analyzing the sample demonstrating the 110 ug/g selenium result, the laboratory confirmed the original result (Table 3). USBR QA staff followed the same evaluation process to determine data result 0.1 ug/g as another potential outlier. Although confirmed potential outlier measurements will remain in the database, periodically USBR QA staff reassesses them as the laboratory generates additional data points for the site by conducting a statistical trend analyses study. Once a data point is statistically proven to be an outlier, USBR QA staff will either flag the data point as a questionable measurement or they will remove the data point from the database entirely.

As a means of assessing both laboratory performance and field sampling homogenization techniques, USBR collected four duplicate sediment samples from the San Luis Drain, one duplicate sediment sample from Mud Slough, and one duplicate sediment sample from Salt Slough and submitted them to the U.S. Geological Survey, Denver Laboratory for selenium analyses. These duplicate sample results (Table 4) provided information on both laboratory performance (precision) and ability of field personnel to properly homogenize samples. USBR QA staff then determined if the results met their established acceptance level. The USBR QA team concluded the values in Table 4 demonstrated acceptable analytical precision by the laboratory and sample homogenization techniques by USBR's field sampling team.

Even though the final duplicate results in Table 4 demonstrate excellent precision, this was not the case when the data report initially came back from the laboratory. The original duplicate results for Site D (whole) differed excessively from each other (0.21 ug/g, 1.5 ug/g). As a result, the USBR QA staff had to determine if the field samplers failed to properly homogenize the duplicate samples or if the laboratory failed to demonstrate acceptable analytical precision upon analyzing these duplicate samples. Upon re-analyzing the duplicate samples for Site D (whole), the laboratory was unable to confirm the initial 1.5 ug/g selenium result for one of the duplicate samples. Based on the laboratory's inability to confirm the original selenium result for one of the duplicate samples, USBR's QA staff concluded the laboratory initially failed to demonstrate acceptable analytical precision for the Site D (whole) duplicate samples. Only after re-analyzing a bracket of samples which included the duplicate samples for Site D (whole) was the laboratory able to demonstrate the excellent

Table 3
GRASSLAND BYPASS PROGRAM
SAN LUIS DRAIN SEDIMENT MONITORING
SELENIUM LEVELS (ug/g, dry weight)

Site B	Whole Core	Re-analyzed Result	Relative % Difference Level	Confirmation Acceptance
June 27, 1996	30	–	–	–
September 04, 1996	20	–	–	–
November 12, 1996	40	–	–	–
March 13, 1997	42	–	–	–
June 10, 1997	0.11	0.18	0.07	± 2RL
September 11, 1997	48	–	–	–
November 18, 1997	41	–	–	–
March 03, 1998	45	–	–	–
June 03, 1998	26	–	–	–
November 09, 1998	17	–	–	–
February 09, 1999	23	–	–	–
June 18, 1999	31	–	–	–
September 16, 1999	26	–	–	–
November 17, 1999	39	–	–	–
March 01, 2000	29	–	–	–
September 27, 2000	19	–	–	–
March 07, 2001	110	100	9.5	≤ 35%

Table 4
QUALITY ASSURANCE RESULTS
GBP SEDIMENT MONITORING PROGRAM
CONDUCTED JUNE 04-06, 2001
DUPLICATES TO MEASURE LABORATORY PRECISION

Site Location	Selenium Levels	Relative Percent Difference (RPD) or Difference	Duplicate Acceptance Criteria
Site D (whole)	0.20 / 0.20 ug/g	0.00	± 2RL
SLD 1/2B (whole)	12 / 12 ug/g	0.0%	≤ 35%
SLD 10/11A (whole)	50 / 50 ug/g	0.0%	≤ 35%
SLD 14/15B (whole)	5.1 / 5.1 ug/g	0.0%	≤ 35%
SLD 17/18A (whole)	50 / 51 ug/g	2.0%	≤ 35%
Site F (whole)	0.73 / 0.71 ug/g	2.8%	≤ 35%

precision for the Site D (whole) duplicate samples in Table 4.

USBR QA staff reviews all field calibration sheets obtained from each agency performing field sampling for documentation of routine instrument calibrations to ensure reliable field measurements for this project.

QA Issues of Concern

USBR QA staff found all the agencies adhered to the protocols outlined in the QAPP.

Uncertainty Associated with Environmental Measurements

As with all quantitative measurements, there is a degree of uncertainty associated with the values provided. This is especially true for environmental data where measurement error may be introduced in the sample collection phase as well as in the laboratory service phase. Program participants and the public need to understand that values presented in laboratory reports are not absolute, but rather represent values with associated precision and accuracy uncertainties as defined in Table 9 of the QAPP. In addition, as the concentration of the parameter approaches the limit of detection for the particular analytical method, the level of uncertainty of the result increases significantly as shown in Figure 4 of the QAPP. The data user needs to understand the degree of uncertainty or the confidence limits associated with the data.

Summary

During WY 2001, the participating agencies in the Monitoring Program complied with the protocols outlined in the QAPP. Adherence to the QAPP ensured the reliability of the data collected and provided the necessary documentation to support the validity of the measurements. Where exceptions did occur, USBR's QA staff was able to quickly identify and address the issues, thereby ensuring the data quality objectives of the program.

During 2001, the USBR QA staff conducted thorough audits of two program laboratories and their own EMT, and continually performed routine review and validation of the data collected throughout the year. When using the data to make decisions, individuals need to know the analytical uncertainty associated with the data. In order to perform QA oversight duties, USBR requires full cooperation from the participating agencies. In performing QA oversight, USBR serves to remind agencies of the need to adhere to protocols established in the QAPP.